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FLIGHT DELAY PREDICTION BASED ON AVIATION

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ABSTRACT - Flight delays have become a significant concern in the aviation industry, impacting passengers, airlines, and airport operations. This research paper presents a machine learning-based approach to predict flight delays using historical aviation data. The study focuses on analyzing key factors such as weather conditions, airline schedules, airport traffic, and departure/arrival times to identify patterns that contribute to delays. Various classification algorithms, including Random Forest, Logistic Regression, and Decision Trees, are applied and compared based on performance metrics like accuracy, precision, and recall. The model is trained on real-world aviation datasets, preprocessed to handle missing values and categorical features. The results indicate that the proposed model can effectively predict delays, aiding stakeholders in proactive planning and decision-making. This research contributes to enhancing operational efficiency in aviation and improving the passenger experience through timely and reliable predictions.

Key Words: *flight delay, aviation, machine,learning, prediction historical data, weather conditions.*

1.INTRODUCTION

In recent years, the global aviation industry has witnessed rapid growth in air traffic, leading to increased pressure on airline operations and airport infrastructure. One of the most persistent challenges faced by the aviation sector is flight delays, which cause significant inconvenience to passengers and financial losses to airlines. Delays can stem from various factors such as adverse weather conditions, air traffic congestion, technical issues, and inefficiencies in airport operations. As a result, accurately predicting flight delays has become a critical focus area for improving operational planning and enhancing the passenger experience.

With the advancement of data science and machine learning technologies, it is now possible to develop predictive models that analyze historical aviation data and forecast potential delays. These models can assist airlines, airports, and regulatory authorities in making proactive decisions, optimizing schedules, and minimizing disruptions.

2.LITERATURE REVIEW

Several studies have been conducted on flight delay prediction using statistical and machine learning techniques. Early models relied on linear regression or decision trees based on structured data such as flight schedules and weather conditions.

3. PROBLEM STATEMENT

Flight delays affect not only the revenue of airlines but also passenger satisfaction and airport operations. Despite various advancements, real-time and accurate prediction of flight delays remains a complex task due to the dynamic and multifactorial nature of aviation systems.2.3 Username and Password Authentication.

4.OBJECTIVES

- Identify and study variables such as weather conditions, airport congestion, airline schedules, and departure/arrival times that influence delays.
- Use real-world flight data from trusted sources and apply data cleaning, transformation, and feature selection techniques.
- Implement and compare models like Random Forest, Logistic Regression, and Decision Tree to classify flights as "Delayed" or "On Time."

Table-1: Technology Stack Used in the Authentication System

Module	Technology Tool Used	Purpose
Programming Language	Python	Core language used for data processing, ML model development, and backend
IDE	VS code	Code development, testing, and model experimentation
Data Handling	Pandas, NumPy	Data cleaning, transformation, and numerical operations
Visualization	Matplotlib	Visualization of delay trends, feature importance, and model results
Machine Learning	scikit-learn	ML algorithms (Random Forest, Logistic Regression, Decision Tree, etc.)

Database	MySQL	Model serialization and saving trained models

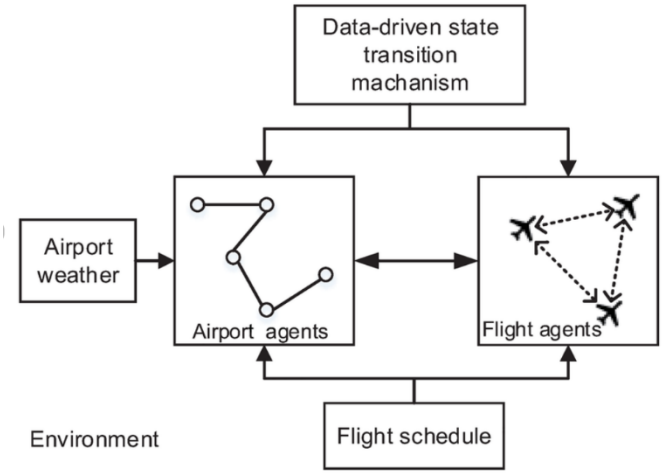

Fig 1: System Architecture

5. CONCLUSIONS

Flight delays continue to be a significant challenge in the aviation industry, affecting both operational efficiency and passenger satisfaction. This research aimed to develop a predictive model using machine learning techniques to forecast flight delays based on historical and real-time aviation data. By analyzing critical features such as weather conditions, airline schedules, airport traffic, and departure times, the study successfully demonstrated the potential of data-driven approaches in enhancing decision-making.

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